Intraaneurysmal GDC Embolization for Ruptured Aneurysm in the Acute Stage
Indication and Results

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Summary

This report focused on our treatment protcol and results on the intraaneurysmal GDC embolization for ruptured aneurysm in the acute stage.

Clinical materials of this study consist of 39 patients who were treated with intraaneurysmal GDC embolization within 72 hours after the onset of subarachnoid hemorrhage from March 1997 to May 1999.

Patients with cerebral aneurysms are always examined as a possible candidate for neurosurgical clipping. If the patient had any difficulties and/or problems on neurosurgical clipping (high age 24, poor grade 12, surgically difficult location 11, systemic disease 2), the patient was treated by intraaneurysmal GDC embolization. GDCs were inserted as tight as possible. Then, spinal drainage was set in patients with thick subarachnoid hemorrhage. Tissue plasminogen activator was administered via the drainage in patients with thicker subarachnoid hemorrhage. Two patients experienced rerupture during peritherapeutic period. Symptomatic vasospasm was observed in 2 patients (5.1%). Good outcome was obtained in 31 out of 34 surviving patients. Symptomatic complication caused by distal embolism occurred in 1 patient, parent artey occlusion in 3 patients.

In conclusion, intraaneurysmal GDC embolization is thought to be sufficient regarding prevention of rerupture, incidence of vasospasm, and clinical outcome.

Introduction

We started intraaneurysmal GDC embolization for ruptured aneurysm in the acute stage in April 1994. Learning from initial series of such cases, we have established our treatment protcol of GDC embolization for ruptured aneurysm in the acute stage.

This report focused on our treatment protcol and results on the intraaneurysmal GDC embolization for ruptured aneurysm in the acute stage.

Patients and Methods

This study consists of 39 patients who were treated with intraaneurysmal embolization within 72 hours after the onset of subarachnoid hemorrhage from March 1997, when our technique of GDC embolization was stabilized, to May 1999. Patients who were initially treated by craniotomy were excluded.

Patients with cerebral aneurysms were always considered to be a possible candidates for neurosurgical clipping. If the patient had any difficulties and/or problems on neurosurgical clipping, the patient was treated by intraa-

neurysmal GDC embolization. Neck plasty technique [1] was not performed in the acute stage but in the chronic stage. Patients' age ranged form 42 to 86 years (av. 73.2). There were 8 males and 31 females. The Hunt and Kosnik (H & K) grade was I in 1, II in 19, III in 9, IV in 7, and V in 3.

The embolization was performed under general anesthesia in all cases. Anticoagulation method was initially systemic low molecular weight heparinization only during procedure till April 1998, then systemic heparinization after deployment of first coil and only during procedure. Double marker microcatheter was introduced into the aneurysm through a 6F introducing catheter. GDCs were inserted as tightly as possible compromising with thromboembolic complication.

Then, spinal drainage was set in patients with thick subarachnoid hemorrhage (Fisher Group II, III) and tissue plasminogen activator (tPA) was administered via the drainage [2] in patients with thicker subarachnoid hemorrhage (Fisher Group III). Tissue plasminogen activator was administered once a day by bolus injection of 2 mg until most subarachnoid clot disappeared in computed tomographic scan findings.

Table 1 **Reason for embolization**

	94/8 - 97/2	97/3 - 99/5
Age	16	24
Poor grade	13	12
Surgical difficulty	8	11
Systemic disease	2	2
Others	5	3

Table 2 **Location of the aneurysm**

	94/8 - 97/2	97/3 - 99/5
ICA	6	16
MCA	3	3
AcomA	8	6
ACA	1	2
VA	2	3
BA	6	8
PCA	0	1
Total	26	39

ACA = anterior cerebral artery; AcomA = anterior communicating artery; BA = basilar artery; ICA = internal carotid artery; MCA = middle cerebral artery; PCA = posterior cerebral artery; VA = vertebral artery

Results

The reasons for GDC embolization were high age in 24 patients, poor grade in 12, surgically difficult location in 11, systemic disease in 2, and others in 3 (table 1). The location of the aneurysms was on internal carotid artery in 16, middle cerebral artery 3, anterior communicating artery 6, anterior cerebral artery 2, vertebral artery 3, basilar artery 8, and posterior cerebral artery 1 (table 2).

Spinal drainage was set in 22 patients and tPA was administered in 12 patients. Symptomatic vasospasm was observed in 2 patients (5.1%). Both patients were treated by spinal drainage alone.

Angiographic result immediately after embolization was complete obliteration (CO) in 9, neck remnant (NR) in 20, and body filling (BF) in 10. Two patients experienced rerupture during peritherapeutic period. Angiographic result at 6 months' follow-up was CO in 3, NR in 11, and BF in 5. Repeated embolization was carried out in 2 of 11 patients with NR and 1 of 5 patients with BF.

Table 3 shows relationship between H & K grade immediately before embolization and Glasgow outcome scale at discharge. In 29 patients with H & K grade I, II or III, 25 (86%) were good recovery (GR) or moderate disability (MD). Even in 7 patients with H & K grade IV, 5 (71%) were GR or MD.

Complications were divided into 3 ranks depending on clinical symptom: major, minor, and asymptomatic. Distal embolism occurred in 4 patients. One patient died of distal embolism (major complication) and the other 3 patients with distal embolism were asymptomatic. Three patients showed parent artery occlusion with major symptom. One of them died of the par-

ent artery occlusion. So, there are 2 mortality derived from complication. Both patients were originally H & K grade II.

Discussion

In this article, we compared recent patients treated by embolization with initial ones. Interestingly, there were several difference between them. Those patients who were treated by embolization because of there poor clinical grade decreased in recent series. We expected favorable effects of embolization for poor grade patients when we started GDC embolization for acutely ruptured aneurysm. However, the favorable effects were minimal, though its surely existed. Recently, we consider H & K grade V as contraindication. In the relation of limited poor grade patients, mortality decreased in recent series.

There were no patients who were treated under local anesthesia in recent series. The principal reason is one excellent neuroanestheologist has had a post in our hospital.

Concerning aneurysm location, ICA aneurysms increased and AcomA aneurysms decreased. That briefly demonstrates ICA aneurysms are suitable for embolization and AcomA aneurysms are not.

We concluded that low molecular weight heparin is not reliable, so we started using regular heparin. The major problem on low molecular weight heparin is not in the drug itself but in monitoring method. There is no reliable monitoring method for low molecular weight heparin. Xa enhanced activation clotting time measurement is not very stable.

Our protcol of GDC embolization for ruptured aneurysm in the acute stage is as follows: 1) General anesthesia, 2) without neck plasty, 3) H & K grade V is contraindecated, 4) regular heparin only during procedure, 5) spinal drainage, if necessary, with or without tPA.

If we follow the protcol above, 80% of all patients and 86% of patients with H & K grades I to III shows good outcome. Complete obliteration is acheived in 30% of the patients. Neck remnant is in 50% of the patients and patients with neck remnant may suffer from rebleeding. Symptomatic vasospasm occurs in 5%. The problems on the GDC embolization for ruptured aneurysm in the acute stage are:

1) Only comlete oblieteration guarantees relief from rebleeding[3,4].

2) Stable embolization is not always performed and retreatment is required in 8% of the patients[5-7].

Conclusions

In conclusions, at present, intraaneurysmal GDC embolization is indicated in the patients in whom surgical clipping is not indicated for the reasons such as high age, poor grade, surgically difficult location, etc.

Table 3 **Relationship between Hunt and Kosnik grade immediately before embolization and Glasgow outcome scale at discharge**

	94/8 - 97/2						97/3 - 99/5					
	GR	MD	SD	PV	D	Total	GR	MD	SD	PV	D	Total
I	0	0	0	0	0	0	1	0	0	0	0	1
II	1	1	0	1	3	6	11	5	1	0	2	19
III	5	1	0	0	1	7	5	3	0	0	1	9
IV	3	2	3	0	0	8	2	3	0	0	2	7
V	0	2	0	0	3	5	0	1	1	1	0	3
Total	9	6	3	1	7	26	19	12	2	1	5	39

D = dead; GR = good recovery; MD = moderate disability; SD = severe disability; PV = persistent vegetative state

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